Boost for SiC in power grid systems

Engineers at the University of Arkansas have been asked, by the federal government, to develop purely electronic systems, to make the nation's power grid more reliable and efficient.

Silicon-carbide, solid-state equipment will replace the electro-mechanical devices like those that failed to localise the 2003 blackout in the Northeast US, the largest and most catastrophic power failure in the history of the country.

"We have to limit potentially catastrophic events so that people don't get hurt and equipment doesn't get destroyed," said Alan Mantooth, UA professor of electrical engineering and director of the newly formed National Center for Reliable Electric Power Transmission. "These events can also severely damage the nation's economy and threaten national security."

Mantooth and three other UA electrical engineering researchers, Juan Balda, Fred Barlow and Aicha Elshabini, received $1m from the US Department of Energy's GridWorks Initiative to create and operate the new national center.

The center's researchers, including faculty and graduate students, will design, test and package the electronic systems for future commercial use in the nation's power grid. Researchers at the University of Wisconsin-Madison, University of Tennessee, Virginia Tech and Georgia Tech received funding for similar research.

Mantooth said government leaders chose the UA team because of the researchers' expertise in advanced power electronics and longtime investigation of SiC, a more durable and faster semiconductor than materials currently used in the power grid.

For the past decade, UA electrical engineers have developed and packaged SiC systems for NASA and the defense industry. The UA team was one of the first to investigate the material's application to power technology.

Mantooth said SiC is a superior material for several reasons other than its strength and ability to respond quickly to power interruptions. Its properties allow an extremely high voltage capability. It is also a good thermal conductor, operating at very high temperatures and does not require extra equipment to remove heat. Mantooth emphasised that this quality can reduce overall mass and volume on a power grid.

For the national power transmission center, researchers will create mathematical models of SiC devices to simulate the design of large systems. Those will then be rigorously tested and packaged. Packaging involves creating protective coatings and enclosures to prevent the material from breaking down, when subjected to high voltages and currents and when interacting with air and water.

Mantooth said the 2003 blackout, that caused billions of dollars in lost revenues and was triggered by fallen branches because of a storm, should have been limited to a local area in Ohio.

The fallen trees caused huge surges of current, which mechanical devices known as fault-current limiters should have squelched, or grounded, to prevent the surges from travelling beyond the local area. However, these mechanical switches did not function quickly or properly, and created a cascading effect, or chain reaction of blackouts. Even with electro-mechanical switches functioning properly, the entire process is too slow, Mantooth said.

"It actually happens in the blink of an eye, but it's not as fast as a computer," said Mantooth. "We want to get the electric system of our country able to react like a computer can react – at electrical speeds, not mechanical speeds.

"The catastrophe of the blackout in the Northeast wasn't the trees that fell on the power lines in Ohio. It was the cascading effect. None of the built-in protection devices reacted quickly enough or properly to limit the problem to a local level. And so you have the entire Northeast grid in disarray.

"That's a reliability problem, and you just can't have such things. What you need is faster-acting, more-reliable, purely electrical systems, what we refer to as solid-state solutions."

Bede wins into CNT, Dresden

Bede has delivered a BedeMetrix-F automated in line X-Ray metrology tool at the Fraunhofer Centre Nano-electronic Technologies (CNT) in Dresden, Germany.

CNT, a public private partnership of AMD, Infineon and the Fraunhofer Gesellschaft will use the BedeMetrix-F to develop and control advanced semiconductor manufacturing processes at a new state-of-the art facility currently being built in Dresden.

Dr Peter Kuecher, who piloted Infineon's 300mm wafer yields, and is head of CNT said, "AMD, Infineon and the Fraunhofer Gesellschaft identified Bede as a leader in X-Ray metrology tools for semiconductor manufacturing, with a growing installed base at major manufacturers worldwide.

"The BedMetrix-F meets metrology needs of the majority of current and future materials and technologies on the ITRS roadmap."

Dr Neil Loxley, CEO for Bede added, "We are excited to be working with CNT to develop applications for X-ray metrology as the European industry transitions to the 90nm and 65nm technology nodes. I believe that the relationship between Bede and CNT will further develop the applications for X-ray metrology in advanced semiconductor manufacturing, and help Bede remain as the leading global provider of X-ray metrology solutions."

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Dresden